Size and Time Resolved Anthropogenic Components of Aerosols via Synchrotron X-Ray Fluorescence: Application to Asian Aerosol Transport.

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Recent aerosol measurements at Mauna Loa Observatory, Hawaii (Perry *et al.*, 1999) have indicated a large flux of particulate matter transported from Asia each Spring potentially with anthropogenic sources. While this report documented components of these aerosols that included trace elements typical of non-ferrous smelters, the data were derived from three-day average filter samples that obscured or lost much of the information available from trajectory analysis. In order to address this problem, Perry *et al.* collected aerosols by time (8 hour) and size (3 sub-micron cuts) from a rotating drum impactor. However, they were only able to analyze the major species (soil, sea salt, sulfates, organics, smoke, etc.) for Asian aerosol transport episodes by proton induced x-ray emission (PIXE) analysis since the masses were very low. We have developed ways of both shortening the time increment (to 30 minutes if necessary) and measuring trace elements (to 0.1 ng/m^3) by using synchrotron x-ray fluorescence (SXRF) microprobe on beamline 10.3.1 at the Lawrence Berkeley Advanced Light Source. For this purpose, SXRF is unique in that it provides an enormous flux (greater than 10^{10} photons/second at 12.5 KeV) of polarized mono-energetic or "white" x-rays focused to a narrow beam spot variable from 2 by 2 microns to 250 by 250 microns. With this capability, we have employed our rotating drum impactors, that separate aerosols into either 3 or 8 size modes, with temporal resolutions ranging from 1 minute to 8 hours over a 1-day to 4-week period. In this report, we apply the SXRF technique to aerosols collected at the University of Washington's Cheeka Peak Observatory on the Olympic Peninsula, using a time resolution of 30 minutes over a major transport episode previously analyzed by PIXE and proton elastic scattering analysis (PESA). The results show the same types and similar concentrations of anthropogenic aerosols seen previously in the 3-day averaged filters at Mauna Loa Observatory. However, dramatic differences appear in the three size modes - 0.07 to 0.34, 0.34 to 1.15, and 1.15 to inlet (about 2 μm) diameter, with the largest anthropogenic component in the optically important 0.34 to 1.15 μm mode. Finally, we track this episode for several days over the western third of the United States, documenting mass levels close to the proposed U.S. health based standard of 65 μg/m^3.

Perry, Kevin D., Thomas A. Cahill, Russell C. Schnell, and Joyce M. Harris. Long-range transport of anthropogenic aerosols to the NOAA Baseline Station at Mauna Loa Observatory, Hawaii. *Journal of Geophysical Research (Atmospheres)* September, 1999.

This work was supported by the University of California Pacific Rim Program.

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